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BETWEEN THE

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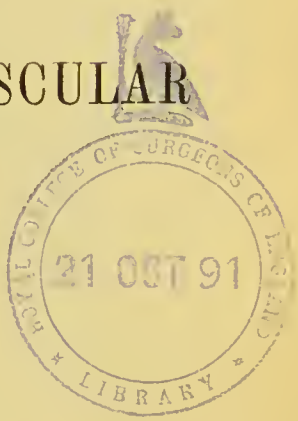

BY

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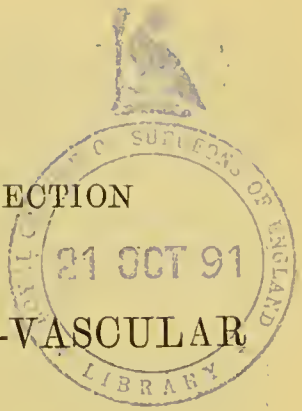

SOME POINTS OF CONNECTION

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EYE AND THE CARDIO-VASCULAR SYSTEM.

By RAYNER D. BATTEN, M.D., B.S.Lond.,
CLINICAL ASSISTANT, ROYAL LONDON OPHTHALMIC HOSPITAL.

Mr. President and Gentlemen,—In bringing my subject before you to-night, I feel that some explanation is necessary to account for my offering so incomplete a piece of work for the consideration of the Society. When I commenced this work, I thought that I was dealing with but a small subject, viz. the relationship between hypermetropia and some forms of cardiac irregularity; and in giving our Secretary so comprehensive a title, my object was merely not to limit discussion to this one point, as I felt there was a possibility of its being but one branch of a far-reaching subject. Subsequent work has convinced me that this is the case, but at present I can only lay before you various facts, suggesting, but not definitely proving, the truth of my theory.

Many points of connection between the eye and the cardio-vascular system are already well established, and others have been suggested by various members of our profession. I propose, therefore, in the first place, to recall to your minds those points which have been already established.

Among the diseases which give rise to both vascular and eye symptoms, chronic albuminuria is probably the most frequent. Syphilis, diabetes, and anæmia (simple and pernicious) I would group with this.

Vascular diseases giving rise to eye symptoms are spontaneous hæmorrhages (hæmatemesis), &c.

Some functional diseases, without definite known cause, show an association between the eye and the vascular system, namely, some cases of chorea and epilepsy; also exophthalmic goitre.

Errors of refraction cause megrims, which are probably due to irregular vascular contraction.

Various poisons and drugs affect both, viz. alcohol, tobacco, atropine, lead.

Broadbent, in writing on high tension pulse, mentions glaucoma as one of the conditions associated with high arterial tension, of which he regards it as a consequence, although the mode of causation is not clear.

There being, then, some *primâ facie* evidence for a connection between the eye and the cardio-vascular system, I propose to bring before you some observations tending to show that the connection is more intimate than it is at present usually considered to be.

Saundby, in his 'Lectures on Bright's Disease,' speaking of optic neuritis, says, "Neuritis probably occurs as an idiopathic affection, especially in hypermetropic eyes." And again, speaking at Birmingham, "I would express my belief that children with hypermetropic eyes are especially liable to severe attacks of optic neuritis, which may be accompanied by headache, vomiting, and giddiness, so as to simulate some coarse intra-cranial disease, the whole phenomena being, however, directly referable to the visual disturbances. I have no doubt that such cases have been met with by others, but I am not aware that anyone has drawn attention to them."*

Gowers, who I believe was the first to describe this

* Saundby, "Note on Optic Neuritis in Children," 'Birmingham Med. Rev.,' 1885.

connection, writes, "One other fact must be mentioned in connection with the diagnosis of the cause of optic neuritis. In many cases in which slight neuritis of chronic course is associated with symptoms which would scarcely suggest the existence of disease such as would cause neuritis, hypermetropia exists.

"This combination may be noted, for instance, in chlorosis, in epilepsy, apparently idiopathic, and other slight symptoms of cerebral disturbance. It is doubtful, in the present state of our knowledge, what share is to be attributed to the hypermetropia in the production of the neuritis, and from the commonness of hypermetropia the coincidence may have been accidental, but the fact deserves notice."

He proceeds to give the following cases:

1. Epilepsy; vague cerebral symptoms; optic neuritis; hypermetropia.

2. Very chronic optic neuritis; obscure cerebral symptoms; hypermetropia.

And on the latter he remarks, "This case may be grouped with the preceding as presenting very chronic optic neuritis, associated with vague cerebral symptoms, in themselves suggestive rather of 'functional' than of 'organic' disease. Here, as in the previous case, the existence of considerable hypermetropia raises the question of the possible dependence of the neuritis on the ocular and cerebral conditions jointly."

He also mentions a case of—

3. Anæmia; hypermetropia; optic neuritis. The patient suffered from palpitations, and he notes that there was distinct cardiac dilatation.

In cases of optic neuritis and anæmia, mentioned by other observers, it is also generally noted that the refraction was hypermetropic. And, personally, I think hypermetropia of frequent occurrence in anæmia.

Dr. Stevens, of New York,* considers that chorea is caused by hypermetropia; and Gowers has noticed the

* 'New York Med. Record,' August 12th, 1876.

connection of optic neuritis and hypermetropia in chorea.

The association of hypermetropia with diabetes, although probably on a different footing, should also be mentioned.

Now, while this association of hypermetropia with diseases causing optic neuritis has been recognised, I do not think sufficient importance has been attached to the significance of it, especially when taken in conjunction with the fact, that optic neuritis from all causes occurs with far greater frequency in the hypermetrope than in the myope, or, I believe, in the emmetrope. Optic neuritis in the myope is, in my experience, unknown, and in the experience of others an occurrence of extreme rarity.

When considering this subject at first, I tried to recollect a case of optic neuritis in a myope, but in vain; and it then occurred to me how very unusual such a condition would appear, especially if the myopic changes were at all advanced. I therefore looked through all the atlases and drawings of ophthalmoscopic diseases that I could find, in order to discover such a case, but in no single instance could I find a disc that even suggested an accompanying myopia.

I have also looked through many descriptions of cases of optic neuritis from varying causes, but have not succeeded in finding any in which myopia is mentioned as a complication, although hypermetropia frequently is. In the majority, of course, no mention of the refraction is made.

But not only is the combination of myopia with optic neuritis rare, but hypermetropia, as far as I have observed, is usually found in connection with such cases.

To ensure myself against drawing rash conclusions from my own limited experience, I have questioned several well-known ophthalmoscopic observers, both surgical and medical, and have obtained opinions drawn from a vast amount of experience, and so far I have collected three cases only of optic neuritis in which myopia was noted.

The universal opinion of those I have asked is, that the association of the two is very rare. Some express doubt as to its occurrence.

Mr. Lawford has kindly sent me notes of one case in which it was observed, but the cause was unknown.

Dr. Habershon* has given me a reference to his paper on hereditary optic atrophy, and in one reported case of this kind, in which optic neuritis preceded the atrophy, the patient was myopic.

Now this fact, if fact it be, of the exemption of myopes from optic neuritis, while interesting in itself, may not at first sight appear to have any connection with the subject before us. But the whole contention of my paper is, that we are wrong in considering hypermetropia and myopia as merely local conditions—they are the "outward and visible signs" of an inward and vascular state. I hold that both are associated with certain general conditions; that the changes which lead to myopia are not limited to the eye, but are part of a general change, and that the arrest of development in the hypermetropic eye corresponds with similar partial development in other structures; in short, that there is a myopic and hypermetropic body, or rather, according to my view, a myopic and hypermetropic cardio-vascular system.

Following on this, it might not be unreasonable to expect that myopes may be free from certain diseases affecting hypermetropes, and also *vice versâ*.

Two explanations have been given me of the absence of optic neuritis in myopes.

1. The comparative rarity of myopia itself.
2. That local disease must have a local cause.

I admit that the frequent connection of optic neuritis with hypermetropia may be partly accounted for by the far greater frequency of hypermetropia, but this does not to my mind offer anything like a sufficient explanation for the total absence of optic neuritis in the myope, save from exceptional causes. Myopia may indeed be rare, but

* 'Ophthal. Soc. Trans.,' vol. viii.

surely not so rare as to prevent common diseases, such as frequently cause optic neuritis, having been observed in myopes, and the occurrence of optic neuritis in a certain proportion of these cases.

The extreme rarity of optic neuritis in myopes would appear to point to one of two things: either a structural difference in the myopic eye; or a structural difference in the body of the myope, rendering him less liable to this form of disease.

Occasional cases of optic neuritis in myopes, from exceptional causes, show that the condition is not structurally impossible. Also we have the anomaly of a supposed "local" disease exempting from a disease which occurs in the normal eye.

But on the point as to whether the myope enjoys any exemption from chronic albuminuria and other diseases giving rise to optic neuritis, I can make no statement; I can only ask for your information or observation on the subject.

I propose, then, to give you shortly the chain of observation which led me to the conclusion that myopia and hypermetropia ought to be considered as indicating a general instead of a local condition; and I would ask you to note that my conclusion was arrived at as the result of my observations, and that it differed entirely from my original theory.

In the post of clinical assistant at Moorfields, the subject of refraction is very much thrust upon one, and the drudgery of it would be most wearisome, were it not for some of its accompanying interests.

Amongst other differences between the two classes of hypermetropes and myopes, the mental and physical differences are early forced on one's notice. But while I had for a long time made mental notes on the two classes and had from time to time endeavoured to reduce my mental notes to words, I had made no serious attempt to investigate the physical state. I had, however, long puzzled over an observation of Mr. Mills on the subject

of heart-failure during the operation of division of the internal rectus in cases of strabismus, *i. e.* in hypermetropes ; and when a case of cardiac irregularity, due apparently to error of refraction, was narrated to me by Dr. Batten, of Gloucester, and corresponded closely with cases of my own, I determined to endeavour to work out what was the connection between cardiac irregularity and hypermetropia, and from this I was led on to the larger subject, viz. the relation of the eye to the cardio-vascular system.

I wish that I could sufficiently group my cases to give you statistics of the two classes, but if you will consider the differences in age, and in degree and kind of refraction, and the numberless combinations to which this alone gives rise, I think you will agree that this is practically impossible.

I propose, therefore, simply to give you the conclusions I have arrived at as to the differences between the two classes, and ask you to take them at your own value. And if my paper induces any others to impartially investigate the subject, it will have served its purpose.

First, then, as regards the peculiarities of what I will for the present term the hypermetropic circulation.

1. *In the young.*—Under this head I include all those not fully developed, and I consider this period of longer duration in the hypermetrope, who, to my mind, reaches his full development later than the myope.

(*a*) *The pulse* is a quick one and is easily accelerated by any cause, and varies rapidly, but the pulse rate apparently does not vary so much with the degree of hypermetropia as with the amount of accommodation. Thus, with latent hypermetropia, I expect a quicker pulse than with a high degree of manifest hypermetropia. The pulse is soft and compressible, not easily counted, and the tension is generally low. But in high degrees of hypermetropia, with bad vision, the pulse is often markedly slow.

(*b*) *The heart,* in the few cases in which I have attempted to take measurements (which I have done by

measuring the distance of the apex-beat and the nipple from the middle line of the sternum), is, I consider, a small one ; but this is not constant, as in some cases the heart appears dilated, and the apex displaced outwards.

(*c*) *The heart-sounds* are generally regular, but with more or less marked accentuation of the first sound. In a certain number I note a rhythm varying with the respiration, and murmurs of a variable and functional character occur. I have also noted loud apical systolic murmurs with more than average frequency. The heart symptoms, in fact, closely resemble those noted in chorea.

2. *The young adult* with hypermetropia is not a frequent patient at the hospital for refractive purposes, but I consider him more liable to local inflammatory disease than the emmetrope, and still more so than the myope.

3. *In the middle-aged and old* hypermetrope I notice, as Brunton has noted, the failure of optical accommodation taking place at the same time as the failure of the *vascular accommodation ;** and hence flushings, giddiness, noises in the ear, &c., are frequently cured by glasses. I note in addition marked cardiac irregularity and intermission, also in some cases disappearing with glasses.

Broadbent has mentioned high tension pulse with glaucoma, and I am inclined to associate it with hypermetropia in the old.

Proceeding to myopia, I regret that I did not at first take equal note of myopic cases as of hypermetropic, as I considered them outside my subject, which was, at that time, simply to consider the causes of cardiac irregularities in hypermetropes. But my present opinion is that the pulse in myopia, with some exceptions, presents certain general characteristics.

The pulse is full, and the artery gives the feeling of being large and thin-walled, and consequently easily felt.

* The term I have employed, "vascular accommodation," is, as far as I know, not in use. I think it is one which aptly describes the power of the vascular system to adapt itself to the calls made upon it.

The artery remains full between the beats, and the pulse tension is slightly raised.

The pulse as felt at the wrist is *recurrent*, and requires to be carefully felt with three fingers, in order to distinguish it from a high tension pulse.

The frequency varies with the condition of the myopia. In healthy arrested myopia, the pulse is slow, and varies but little. With progressive myopia, the pulse is often quick, while in some cases of high progressive myopia with unhealthy fundus, and vision not greatly improved by glasses, I have observed a very rapid pulse and frequent palpitations, and under these circumstances I have been unable to distinguish the ordinary characters of the myopic pulse.

Accentuation of the second sound of the heart, especially to the right of the sternum, accompanies the myopic pulse, and other alterations of the heart-sounds often occur. I have noted murmurs of one kind or another in several cases.

The action of atropine, locally applied, I at first thought would have been of much help to me, but I have found it most difficult to know which symptoms to attribute to its local, and which to its constitutional effects.

The rapid hypermetropic pulse atropine generally slows, sometimes in a most marked degree, a pulse of 120 dropping to 88 under its action.

A slow pulse, on the other hand, is sometimes quickened, or generally left much as it was.

In myopia the slow pulse is but little altered by atropine, and I have not seen the slowing of the rapid myopic pulse under its action.

As regards the treatment of the two conditions by glasses, and its after-effects, I regret that I am unable to give you any full information, for the hospital out-patient, having obtained his glasses, generally disappears until he requires fresh ones. I have, however, seen the pulse fall and cardiac irregularity disappear in hypermetropia with their use. But in the reverse cases, by which I mean

those in which patients have come under treatment for cardiac symptoms, and in which I have found well-marked hypermetropia which I assigned as the cause of the cardiac symptoms, I was disappointed to find that the correction of the hypermetropia by glasses, or the paralysing of the accommodation with atropine, did not markedly slow the pulse. This at first appeared to me to be fatal to the theory that hypermetropia was the cause of the heart-hurry. But with the view that the cardio-vascular system itself is "hypermetropic," it seems reasonable that, although the use of atropine and glasses might remove the source of irritation, it could not alter the structure of the cardio-vascular system. And here, if not unduly trespassing on your time, I will shortly narrate two or three cases, which I consider show the action of hypermetropia on cardiac irregularity.

The first is that of a boy of twelve, who, after a slight feverish attack, which kept him in bed four days, was observed to have some cardiac irregularity, which persisted, and was considered of sufficient importance by his own medical attendant, and a consulting physician, to require him to give up all games and every exertion of an active character. About two months later, he was examined by Dr. Batten, of Gloucester (to whom I am indebted for the notes of the case), who found that the heart's action was still irregular, but that there was no evidence of any actual disease. He noticed, however, some hypermetropia, R. and L. + 1·50, and ordered glasses to correct this. When seen some time afterwards, all cardiac disturbance had disappeared, although the boy had returned to athletic pursuits. This took place early in 1886, and in 1889 he obtained his "blue" for football while at Cambridge University. At a later date, however, after some sudden severe exertion, he appears to have had a fainting attack, but subsequent examination revealed nothing wrong with the heart. His optic discs were examined at the first consultation, and found to be normal.

The second case is that of an old lady, æt. 65, who

came complaining of great giddiness and vertigo, the cause of which was not obvious, as she complained of both heart and eye symptoms. On examining the heart, the apex was slightly displaced outwards, the pulsation was intermittent and very irregular, there was a doubtful thrill, the first sound was accentuated and preceded by a slight roughening. On examining the eyes I found + 3 D. of hypermetropia. I fully corrected her vision. Three years afterwards, when I again had occasion to attend her for some gastric trouble, I carefully examined the heart, but could find no trace of its former irregularity and intermission. The vertigo had also practically disappeared.

The next is the case of a man, æt. 40, who had high hypermetropic astigmatism. He also complained of severe palpitations and occasional intermission, and stated that these were brought on if he attempted to use his eyes for near vision without glasses. The examination of the heart revealed nothing abnormal at that time.

Mr. Mills, chloroformist at St. Bartholomew's Hospital, kindly answering my letter, writes as follows :—

"During the operation for the division of the internal rectus in squint cases, I have very often noticed an alteration in the pulse. In some cases, one beat was omitted, in others two or more. In some cases, the beats became very feeble, and remained so for some seconds ; and in many cases there was very severe syncope, lasting some minutes. This always came on suddenly, in most cases at the moment of division of the internal rectus ; in a few it occurred when the tendon was put on the stretch before division. There have been many deaths under chloroform during operations for strabismus."

These cardiac intermissions, then, appear to occur only on division of the internal rectus, and only in internal strabismus cases, *i. e.* only in cases of hypermetropia, or at all events mainly so. Hence there would appear to be some condition of heart, or nerve-connection with the heart, special to hypermetropes, rendering them liable to this form of cardiac irritation.

Mr. Priestley Smith,* speaking on the causes of myopia, compared it to a kind of rickets, but apparently considered it as a local rickets, dependent on local causes. I would also consider myopia a kind of rickets, but, like rickets, having a constitutional cause, and producing its effects on other structures besides the eye; and that the treatment of myopia by glasses alone is much on a par with treating rickets with irons and splints alone, or letting out a waistband to accommodate an increasing ascites.

Of course, hygienic defects are often referred to as the cause of myopia; but, as far as I know, no attempt has been made to classify or state what the effects of this faulty hygiene are, what class of concomitant symptoms we are to expect. In fact, the eye as the main symptom has completely overshadowed all others, and until we have a more thorough knowledge of the causes and symptoms (other than the eye) of this disease, I do not think much progress can be made towards its treatment or its prevention.

Myopia, with its local and general changes, has, like the rickets of bone, its period of activity, runs it course, and produces effects more or less severe; and as the period of its active progression comes to an end, the tissues, more or less damaged and altered in shape, recover their condition, and are more or less capable of carrying on their functions.

But again in later life, in a few myopes, I have known cardiac and vascular changes to assert themselves, and in one case to progress along with an increase in the myopia.

Of course I do not mean to hold that a general constitutional cause of myopia can be found in all cases, as it is obvious that many must be due to some local cause, *e. g.* those in which one eye is myopic, whilst the other is hypermetropic or emmetropic. Also the causes which lead to astigmatism would seem of necessity to be local.

I have already expressed my opinion that the hypermetrope reaches his full development later than the

* 'Brit. Med. Journ.,' September 27th, 1890.

myope, and he appears to carry some of his youthful characteristics far into adult life, and, as far as my experience goes, I should say attains a greater age.

All young children are said to be hypermetropic, and I think it is reasonable to consider that when the condition persists into adult life, the eyes may be said to retain their youthful characteristics.

And if it can be proved that the cardio-vascular system is associated in any way with the eye in its development, it does not seem unreasonable to me that the hypermetropes should be liable to take their illnesses with youthful characteristics, or, at all events, with differences from those in whom the cardio-vascular system is fully developed, or over-developed, as in myopes.

And here I would ask you to consider whether the usually received theory as to the sedentary habits of a myope is wholly correct. The reason commonly given is that he sits still because he cannot see to take active exercise. But the most *obvious* is not necessarily the most *correct* explanation. And I would suggest that he sits still because his vascular system does not enable him to take active exercise with comfort.

There are a few other points which I will mention, points on which I have as yet done but little work, not even sufficient to form an opinion of my own. But if I may be allowed to state them shortly, they will show, or tend to show, the direction in which, I think, observations should be taken.

First, then, as regards development and hereditary causes. I now, whenever opportunity presents itself, endeavour to obtain from the mother of the patient some account of the size of the child at birth, compared with that of her other children, and the answers that I have obtained, in the few cases I have tested, suggest that the hypermetrope is small at birth, while myopes have generally been large children. On asking the mother of a myope, she replied, "Oh yes, he was a very fine child, but fell away after five years. He is not a strong child now."

Mothers of hypermetropic children, on the contrary, often confess to their children having been peculiarly small at birth. My attention was called to the point in a family, all of whom were particularly small at birth (one premature). They are, I believe, all hypermetropic, and as a family noted for taking febrile affections, and having them severely, with well-marked rigors, high temperature, &c.; and a slight disturbance of digestion will produce temperature of 103°, convulsions, &c. They are now, however, remarkably fine, well-grown children, and very active.

Secondly, the giddiness and faintness frequently shown by patients having their refraction tested, and the well-known association of megrims with defects of accommodation, tend to show the effect of muscular spasm in accommodation and convergence on the cardiac and vascular system.

The subject of muscular spasm has suggested to me the possibility of a connection between the refraction of a patient and his susceptibility to hypnotic influences. But as on the subject of hypnotism I know but little, and have no experience, I should be glad if any one can tell me whether myopes or hypermetropes are the more susceptible subjects.

Treatment.—I now come to the subject of treatment of the hypermetrope and myope, and by treatment I mean the constitutional treatment as opposed to mere local treatment by glasses. Not that I have at present anything to state on this subject, for I have felt that my theory was not sufficiently proved to warrant my starting a course of treatment either to aid the developmental defects of the hypermetrope, or to check the progress of the myope. But I am convinced that the present method of treatment, in the case of myopia at least, is irrational, and lays itself open to severe criticism. In a case of progressive myopia, we order glasses, more or less fully correcting according to the surgeon's view of their local effect in increasing or preventing increase of the myopia.

Then the patient goes away for a time, only to return with weaker vision, requiring a stronger glass. It is true that, when the patient's sight declines rapidly, or when no glass will help him to see clearly, we do give other treatment, but, as far as I have seen, it is given empirically, or only with local indications. We blister his temples, or leech him, give him coloured glasses, order quinine and iron, and forbid him to use his eyes for near work, or to stoop. The treatment may, of course, be the very best we are capable of, but I must confess I should like to know the *reason* of my failure, and not to rest content simply to watch it helplessly because it progresses slowly, and there is always a hope that it may become stationary.

Correction of refraction by glasses has done much to aid the physician in the diagnosis and treatment of headaches, and will, I trust, in the future help still further in the diagnosis, if not treatment, of some forms of heart disease.

It is time, I think, that the physician lent his aid to the surgeon in refraction cases; for in this, as in some other diseases, the most obvious symptom is not always the one most requiring treatment.

The physical signs should be of use in establishing the diagnosis between arrested and progressing myopia, the quick pulse of the progressive markedly contrasting with the slowish pulse of the stationary myope.

As to what may be done to aid the hypermetrope to overcome his defects, I am not yet clear, but I am convinced that he sometimes requires constitutional as well as local treatment.

Glaucoma is another disease in which the main symptom has overshadowed all others, but I would express my belief that it is a constitutional disease in origin, and that the occurrence of the increase of tension is to a certain extent an accident only, which the general condition has rendered possible. Of course, in the present state of our knowledge, the treatment of its main symptom must remain in the surgeon's hands; but it is to my mind a

disease which urgently demands investigation by the physician.

In this paper I have called your attention almost exclusively to the refraction side of this subject. But I have done so purposely, not because I do not realise that there are points of more obvious connection between the eye and cardio-vascular system, and of even greater importance.

In conclusion, then, I hold that there is evidence of an intimate association and connection between the eye, in its muscular, nervous, and vascular structure, and the cardio-vascular system, both in health and disease. And in this connection—

I. As regards hypermetropia :

1. There is a hypermetropic form of circulation, partly structural and partly functional.

2. This form of circulation is liable to influence the type of disease in the individual.

3. It gives rise to cardiac irritation and functional disease, leading to mal-nutrition.

II. As regards myopia :

1. The changes which lead to it produce also a change in the circulation, mainly structural, partly functional.

2. The form of circulation so produced appears to render the individual less liable to some and more liable to other forms of disease.

And now it only remains for me to thank you for having listened patiently to my paper. I am myself fully conscious of its many defects.

The facts are too few to justify such large conclusions. And I expect that both my observations and conclusions may be made to bear a totally different explanation from that which I have given. But I hope I have shown sufficient basis of fact to justify my bringing the subject before you, and to induce others to work at it.

"I could proceed further, but methinks I can hardly forbear to blush when I consider how the most part of men will look upon this; but, yet again, I have this

encouragement not to think all these things utterly impossible, though never so much derided by the generality of men, and never so seemingly mad, foolish, and fantastic, that as the thinking them impossible cannot much improve my knowledge, so the believing them possible may perhaps be an occasion of taking notice of such things as another would pass by without regard as useless."*

* The Posthumous Works of Dr. Robert Hooke, 'The Method of Improving Natural Philosophy," 1705.

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